Claims 22-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's Admitted Prior Art ("APA") in view of U.S. Patent No. 5,788,510 to Walker. Claims 29-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's Admitted Prior Art in view of Walker and further in view of U.S. Patent No. 6,033,236 to McHugh et al.

In the mounting of an integrated circuit (IC) on a plastic or ceramic substrate, the use of a ball grid array (BGA) has become common and well established technology. In a BGA package, spherical solder balls attached to the IC package are positioned on electrical contact pads of a circuit substrate to which a layer of solder paste has been applied. The unit is then heated to a temperature at which the solder paste and at least a portion of each solder ball melts and fuses to an underlying conductive pad formed on the circuit substrate. The IC is thereby connected to the substrate without need of external leads on the IC.

More complex, however, is, a corresponding process and structure for mounting an electrical connector or similar component on a printed wiring board (PWB) or other substrate. It is important that the substrate-engaging surfaces of the solder balls are co-planar to form a substantially flat mounting interface, so that in the final application the balls will reflow and solder evenly to a planar printed circuit board substrate. Any significant differences in solder co-planarity on a given substrate can cause poor soldering performance when the connector is reflowed onto a printed circuit board.

A problem presented in soldering connectors to a substrate is that connectors often have insulative housings that have relatively complex shapes. Residual stresses in such housings can result from the molding process, from the buildup of stress as a result of contact insertion, or a combination of both. These housings may become warped or twisted either initially from the molding process or upon heating to temperatures necessary for subsequent processing, such as temperatures necessary to reflow the solder balls. Such warping or twisting of the connector housing can cause a mismatch between the connector assembly and the PWB, resulting in non-co-planarity and unreliable soldering because the surface mounting elements, such as solder balls, are not sufficiently in contact with the solder paste or close enough to the PWB prior to soldering across the entire mounting interface of the connector.

The present invention is directed to a connector that exhibits high co-planarity along the mounting interface. Co-planarity of the surface mounting interface of the connector is maintained by

providing an insulative connector housing in which stress buildup is avoided. The present invention accommodates the deformation or warpage caused by thermal cycling that would otherwise cause the stress buildup during a reflow process employing heat. The connector avoids stress buildup by providing a connector housing that incorporates compliant sections corresponding to the areas where the greatest deformation in the connector is expected. According to this aspect of the invention, the housing has notches or slots at locations furthest from the neutral point of the connector. By means of this arrangement, stress buildup is avoided during a reflow process employing heat, so as to minimize warping and twisting of the housing.

Fig. 3 is a side view of an exemplary BGA interface connector in accordance with the present invention, Fig. 4 is a perspective view of the BGA interface connector of Fig. 3, and Fig. 5 is a bottom perspective view of the BGA interface connector of Fig. 3. The housing 15 has openings 12 in sidewalls that are placed at desired locations so as to allow the housing 15 to be compliant along desired axes. As a result, a reduction in solder joint stress between the connector 10 and its mounting substrate (such as an underlying PWB) results. Thus, during thermal cycling, the effects of the differential in the coefficient of thermal expansion of the PWB substrate and the connector 10 are minimized. Moreover, the co-planarity of the contacts is improved, and stress buildup is avoided during a reflow process employing heat.

Concerning independent claims 22 and 28, in the rejection, the Examiner states that:

> Walker[1] discloses a connector comprising a notch (E1) located only at a location furthest from neutral point of the housing...
>
> Although Walker does not specifically disclose the slot (E1) is for the purpose of preventing warpage problem of the housing caused by thermal cycling. The structure disclosed by Walker would inherently obtain the advantage of the slot being present in the housing. Thus, it is capable of preventing warpage in the housing.

[1] The APA requires little comment here since it admittedly lacks the features of the invention, hence the Examiner's need to apply or add Walker and/or McHugh.

> It would have been obvious to one having ordinary skill in the art to modify the connection housing of Applicant's APA with a slot only at furthest location from neutral point of the housing. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Marsham*, 2 USPQ2d 1647 (1987).

Rejection of May 22, 2002, at pages 2-3.

This rejection should be reversed for various reasons.

1. Walker does not actually "teach anything" concerning "notches"

Regarding Walker, the Examiner places great credence on what he labels "E1" in Figure 1 of Walker. The Examiner states that E1 of Walker is furthest from Walker's neutral point, would inherently obtain the advantage of preventing warpage because it is capable of doing so, and therefore alleges that claims 22-28 are obvious over the APA in view of Walker.

However, the reason the Examiner has to label the "notch" of Walker "E1" is because Walker himself does not label it anything -- seemingly reducing this feature to some kind of insignificant triviality. Indeed, in actuality, Walker does not --to use the Examiner's words-- "specifically disclose" *anything* about the "notch" and is absolutely silent to why that "notch" is there and what purpose it serves. Walker's "notch" is certainly not there to prevent warpage during a reflow process as required by the present claims because as a through-hole connector (see also, ¶2 below), Walker's connector would not go through the heat history and heat profile associated with a reflow process.

To think that one skilled in the art would look at Walker and actually incorporate such a blind "teaching" concerning these "notches" is just not reasonable.

2. Walker is in no way related to BGA technology or its problems

Walker is unrelated to a connector such as the APA that is involved in a reflow process employing heat. Walker is a completely different type of connector faced with completely different issues. Walker is a through-hole connector as indicated by solder tails 76. Co-planarity is not critical in such a connector because of the larger electrical contact surfaces of solder tails 76.

Accordingly, even if somehow through some type of heating, Walker's housing was warped, etc., the warpage's effect on electrical performance might completely go unnoticed due to the fact that the long solder tails 76 can take up the slack of dimensional imperfections. Thus, no one skilled in the art would know that Walker's notches cure a warpage problem because there would be no electrical evidence of a warpage problem in the first place.

Moreover, the combination of the APA and Walker is simply not a valid combination. The APA is a "board-to-board" type of connector employing surface mount connecting techniques, and Walker is a through-hole connector. Such connectors cannot be combined.

One skilled in the art, faced with complex co-planarity problems and CTE mis-match problems in a high-speed board-to-board surface mount connector such as disclosed in the APA would never look to a low-tech (relative to the APA) through-hole connector such as Walker that does not face any of the same problems. Thus, for at least this reason, the combination of the two must fail.

3. The Examiner's Inherency Argument is Flawed

The Examiner states that Walker's cutout would inherently obtain the advantages of Applicant's. This is a flawed statement.

a. No General Factual Support For Such Conclusion

The Examiner states Walker's "notch" is inherently capable of preventing warpage. There is absolutely nothing in Walker to support that conclusion. Indeed, "notch" E1 can be a manifestation of the manufacturing of the part, i.e., positioning tool placement. Furthermore, there is no reason not to believe all the "notches" must be present together. The absolute silence of Walker places too many doubts as to the "teaching".

On the other hand, Applicant claims a specific location for their area of reduced rigidity. In claim 22, for example, the areas of reduced rigidity are located where it is known that stress will build up due to the heat of the reflow process and the materials from which the connector housing are made. Such locations can be easily predicted by modeling as well as testing and are then predetermined.

b. No Factual Support For Such Conclusion That Meets *MPEP* Requirements

This also fails on sheer lack of evidence. The Examiner's conclusory statement does not rise to the almost sheer certainty required by *MPEP §2112* ("may" is not sufficient; "characteristic necessarily flows"). Furthermore, there is certainly no objective evidence or cogent technical reasoning to support the conclusion of inherency. *Id.*

4. Reliance on *Ex Parte Marsham*

Though the final paragraph of the Examiner's rejection starts off with "It would have been obvious to...", the Examiner does not actually provide the necessary motivation to support a 35 U.S.C. §103(a) obviousness rejection. Rather, it appears that the Examiner is relying on the *Marsham* case for his motivation. Admittedly, reliance upon case law for motivation is sometimes proper.

However, even if *Marsham* were applicable and that somehow boot-strapped Walker's "notches" to the level of significance of Applicant's specifically located areas of reduced rigidity, that would not detract from the fact that the Examiner's rejection still lacks the motivation to provide the APA with the Walker "notch". In other words, even if it is concluded that despite Walker's silence, his "notch" does either do everything Applicant's areas of reduced rigidity does or can do everything or can be used to do everything Applicant's areas of reduced rigidity does, the logical step still has to be made that it would have been obvious to provide the APA with Walker's "notch" when Walker provides no motivation or even implicit suggestion as to why one skilled in the art would want to do so.

Next, the Examiner's reliance on *Marsham* for his motivation is misplaced because *Marsham* is a §102 anticipation case and not a §103 obviousness case. The case speaks nothing on motivation to combine. The case discusses whether one device that is exactly the same as another except for intended use can anticipate the other. In the instant application there are not two identical devices. Therefore, the applicability of *Marsham* is misplaced.

5. McHugh et al. fails to cure the deficiencies of the APA and Walker

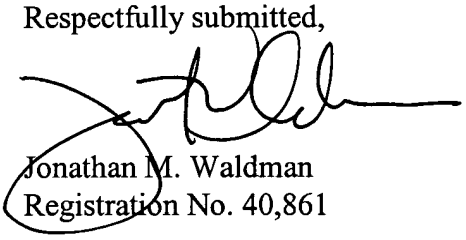
The Examiner states that McHugh et al. discloses a portion of a housing is removed to form a passageway, thereby defining an open slot. The Examiner states that the open slot will prevent a warping problem and points to a passage in McHugh et al. that describes warpage of the housing (col. 3, lines 13-22). The Examiner concludes that is would have been obvious to one skilled in the

art to remove a portion of the housing where the stress is high as taught by McHugh et al. However, McHugh et al. is unrelated to a reflow process employing heat, and therefore, the slot is not there to prevent warpage during a reflow process. Instead, the slot in McHugh et al. is merely related to a tolerance space for any warpage that may occur due to the relatively large height of the housing. Furthermore, McHugh's slot is related to the proper retention of the vertically positioned contact within the housing and not the maintenance of co-planarity of a surface mount connection between a connector and its associated substrate. Thus, one skilled in the art, when seeking to prevent warpage during a reflow process, would not look to the slot of McHugh et al.

For the foregoing reasons, Appellant submits that the inventions recited in claims 22-31 fully comply with the requirements of 35 U.S.C. § 103(a). Withdrawal of the rejections of claims 22-31 is respectfully requested.

In view of the foregoing remarks, Applicants submit that the above-identified application is in condition for allowance. Early notification to this effect is respectfully requested.

Respectfully submitted,



Jonathan M. Waldman
Registration No. 40,861

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WOODCOCK WASHBURN LLP
One Liberty Place - 46th Floor
Philadelphia, PA 19103
(215) 568-3100